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The rebirth of natural fibers? Analysis of market potential for fique (*furcraea andina*) production in Santander, Colombia

Abstract

Natural fibers extracted from the leaves of the fique plant *(Furcraea andina)* are currently used by the Colombian market mainly for the manufacture of coffee sacks and crafts. However, the economy associated with the cultivation of fique in the department of Santander is weak and optimal production practices have greatly been abandoned by farmers because of poor market demand in the last two decades. However, new market demand for natural, eco-friendly fibers to replace plastic opens up better opportunities for fique producers. The objective of this study was to provide a macro view of the current fique market in Colombia and its potential in modern markets. The study of production aspects, economic situation and market potential was conducted with 25 producing families where relevant information to characterize the current situation was obtained. Data on production practices, market access and economic situation was collected. The results revealed that fique production can help improve the economic situation of rural families in Santander, but that the production system can be improved and optimized to generate a higher income. Currently, there is a market potential in natural fibers, but more investments need to be made to train farmers in sustainable production practices and compliance with new standards and certifications. Additionally, local artisans need to improve the products they produce with the fiber to meet the new demands in the eco-friendly, natural fiber market. A set of strategies and recommendations for improved market access for small-scale producers and artisans using both modern and traditional techniques was drawn.

Keywords: colombia, fibers, fique, value chain

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Introduction

The next report has the objective to introduce and explain the actual market of Colombian fique production in Santander area, issues that it has, and possible improvements. Fique (*Furcraea spp.*) is a South American tropical plant from Agavaceae family, used locally to make ropes, sacks, and clothes. Fique is a monocotyledon plant from 2 to 7meters high and the cylindrical structure of the stem usually has between 75 and 100 leaves that keep inside the fiber also known as *cabuya*.[1] In spite of fique fiber is similar to sisal (*Agave sisalana*) or yute (*Corchorus capsularis*), it is less known thus less popular in markets. FAO[2] estimate that sisal production is 300'000 ton/year and yute is close to 3million ton/year, while fique production is 16'000 ton/year and decreasing.

Fique Colombian market is divided in 5 productive regions, being in first place Nariño and Cauca with 75% of fibers production, while the contribution of Santander is just 11%.[3] In spite of this gap, Santander is still an important member in national fiber market and one of the strategies that some companies are using in the area is differentiation in handcrafted products and to begin business with international markets. Nevertheless, it is not enough to solve the poverty problems and abandonment of fique production in the region. Before to describe how they are trying to improve the market is necessary to explain what are the adversities in terms of society and the crop itself. In one hand it is possible to describe the population as elderly people that depend economically of fique and without another source of income, reason why they must to hire workers to do the job. In the other hand, due to the physiology of the plant, farmers can harvest fique leaves 3 to 4 times per year, which means that they do not receive incomes every month.

Materials and methods

The system used in this project consisted in a personalized survey that studied every fique farmer found in Santander area, specifically on the roads between San Gil, Curiti, Pitiguao, Mogotes, San Joaquin, and Onzaga. The total amount of families studied corresponds to 25 families, each one with 3 people in average living in there. The total amount of hectares surveyed *in situ* was 106, but the estimated surface covered by the study corresponds to 56'621 hectares. In addition to farmer's families, the research involves the local markets inside the areas, commercialization systems, and mayor processing companies. The core of the survey has the purpose to evaluate the knowledge about their own farms, financial situation, knowledge about sub-production with fique waste, and knowledge about environmental risks caused by fique's juices. Results were tabulated in a simple matrix and calculated with descriptive statistics.

Results

The main results were divided in 3 topics: productive chain, economy system, and environmental impact. To analyze the first one is mandatory to briefly explain how is the productive chain in a common situation. Fique is a long time crop able to live until 20years and this can begin to be harvest after 3 or 6years from plantation. The harvest is a handmade process that consists in a clean cut in leaves base. After that, fiber is removed from the core of every leaf

and the waste produced in this process is called "juice and bagasse". The next step is the cleaning of fiber known as "fiber washing" and that can be made in the river or in a washing tank. And finally, the product must to be sun-dried, packaged, and sold.[1,4] In Santander province, 88% of farmers hire external workers to obtain the fiber and at selling time 80% prefer to do it to an intermediary, instead of selling directly to a company or local handcrafter. The reason why they used a third party is just a tradition, while the other 20% that sell their products directly to companies or handcrafters assert they have a deal with their buyers and they can sell the whole production and obtain a better price. Additionally, intermediaries have two different ways of commercialization, the first is direct selling to companies or handcrafters, and the second is working with other intermediaries that sell the *cabuya* to sacks handcrafters, then they re-buy the half finished sacks and re-sell to another sacks handcrafters that finishing the job and sell the final product to the final buyer. These four different ways of commercialization are described in the next Figure 1.

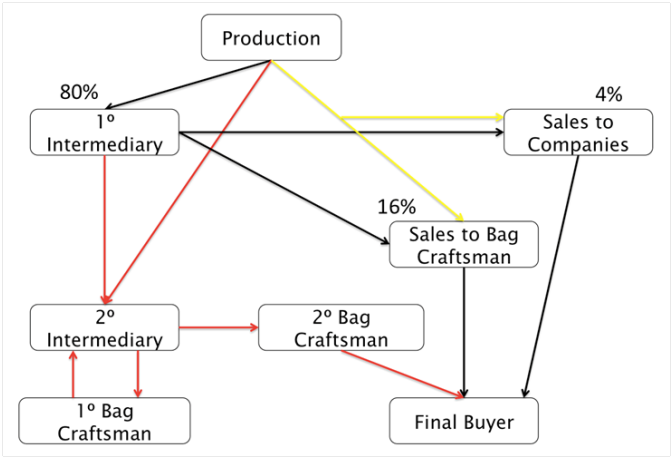

Figure 1 Simplified diagram of fique commercialization.

If one goes into the market *per se,* it is possible to notice that 80% of fiber is destined to industrial market of bags and cords, and the 20% remaining is to handcrafters. Nonetheless, the whole production of Santander is not enough to supply the industrial market and the main company -Coohilados del FonceLtda- must to buy the 70% of their raw material to another provinces like Cauca or Nariño, what increase their costs. On the other side, the biggest firm of handcrafts is "EcofibrasLtda" and they have an impact in Colombian market and also international market. The core of this company is the handmade production of carpets, baskets, espadrilles, among other products, and the 60% of their sales is in the United States and Swiss market.[5] Analyzing the second topic "economy system" is possible to find that 100% of farmers knew and manage the productive chain, and 76% confirmed that fique was the most important crop in their farms, this means that fique is the most important source of income that they have. Additionally, 36% of people have less fique than in previous years and 48% of farmers have the same amount over time. In spite of the reduction of planted surface people consider that fique is still a good crop, because is strong and healthy and the only problems that they have is the high cost to replant dead material produced by climate change and low sale prices. That is the reason why 32% of farmers would not change fique by any other crop and 44% would like to try mixing crops with fique and other plants.

Changing the subject, during the year of the study the minimum wage in Colombia was 737'717 Colombian Pesos (COP), equivalent to 273,4 United State Dollar (USD) and the selling prices and average amount produced are described in Table 1. As previously mentioned, the major part of fique farmers prefer to hire temporary workers during the harvest time, on one hand because the peeling machine is expensive and the size of individual farms are not big enough to make the investment. On the other hand, farmers are an aged population and they are not physically capacitated to do hard works, which means that the one possibility to obtain fiber is paying for the service. And despite all the effort and cost the perceived profit is less than 30% of a minimum wage *per capita,* that was exactly the same situation registered in 1981 by León Zamosc.[6] Due to this condition, farmers had to think how to improve their life style and they started a subsistence economy system where people must to sow edible crops like sugar cane, yucca, or coffee, also they began to raise animals to eat, mainly chickens.

Table 1 Average prices paid to farmers and average amount of fique produced

Ranking	Average price (USD)	Average amount
First category (1°)	1.12	29%
Second category (2°)	1.02	67%
Third category (3°)	0.79	4%

Now the real question is why farmers do not have a better profitability? Basically the yield of fique is 4% of fiber and the remaining 96% is waste. Historically farmers have used fique waste as fertilizer, and actually works well, but throw over the soil 96% of resources is not profitable. Moreover, contemporary studies have shown that both –bagasse and juice- can be used as resources in pharmaceutical market, agricultural industry, or even to increase the strength of diverse materials like bio-plastic or concrete. To better understand this situation in table 2 is presented a summary that compare the most relevant data in terms of crop over time of fique and sugar cane (*Saccharum officinarum*), another crop that grown in the area. And continuously two hypothetical cases with the purpose of compares fique's income without any use of sub-products elaborated with waste and fique's income with the additional income of those new products. During the study, no matter the comparison the income produced by sugar cane was always higher than produced by fique. As one can observe in Table 2 this situation is consequence of time needed before the first harvest and also the difference of yield in every crop. In other words, fique production does not have any profitability before 3years, while sugar cane has incomes after one year of planting and yield of sugar cane is almost 100 times higher than fique. Additionally, fique fiber is only the 4% of the whole material; this means that selling prices are relatively low to cover the cost, even if the selling price of sugar cane is 96% lower than fique.

Table 2 Summary of fique and sugar caneat year 2014in addition to estimate price to 2026.[4,7,8]

Crop	Yield (ton)	Planted area (ha)	Surface (ha) 2007-2014	Year of 1° harvest	Price USD/kg	Price 2026 USD/kg
Fique	1,32	15'426	-40%	3	0.73	1.25
Sugar cane	122,14	237'945	17%	1	0.03	0.3

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The first hypothetical case measures the extra income that could be obtained if farmers use a small part of waste in the creation of products with market value. Both products analyzed below are easy to make and have a real market. The first one is the manufacture of natural soap, that use 1/3 liter of fique juice pro bar, if one consider that 1 hectare of fique produce almost 40 ton of juice during the harvest and using 100Lt farmers could make 300 soap bar, then they could get 9.4 USD/monthly extra if they selling 25 soap bar. In other words, with less than 1% of total juices farmer could increase 4% their salaries and that is consider a subtraction of cost for extra materials, production, and storage; a 78% of total.

The second case employ less than 1% of the solid waste of fique; that produce 57,6 ton/ha of bagasse in every harvest. Bagasse can be used as substrate in mushrooms growing, in this case oyster mushroom (*Pleurotusostreatus*) that are sold in 4.5 USD/Kg. As the previous example, here was necessary to subtract all the associated costs and the extra income is 11.4 USD monthly. Changing the subject, the third topic to analyze in this part is "environmental impact" specifically, damage caused by fique juice in rivers' aquatic life. It is known that fique juice is highly caustic, actually in previous researches made by CADEFIQUE[9] they could demonstrate that is more toxic than agrochemicals like "Mancozeb" or "Propanil". This contamination is made during the washing process, because farmers clean the fiber in rivers and the residual juice of *cabuya* spreads in water. The solution to decrease this problem is to use washing tanks instead of cleaning in the river, but only 8% of farmers use this tanks. Investigating a little was easy to understand that every farmer knew about this risk, but less than 30% had a capacitation in this area and another 20% saw *in situ* the damage caused in rivers, all the rest just had a notion about the problem because they were always being heard. In one hand, 32% people assert that they would not use a tank, because rivers in this area do not have fishes, 52% prefer to stay out of the discussion, and only 16% affirm that they will use a washing tank if they had one. In other hand, the building cost of a tank are really high and some areas have not water enough to fill them, that is other reason why people is reluctant to that idea.[10–19]

Discussion

As seen at a glance, fique farmers are below the poverty line because they earn one minimum wage per family, and this situation was made in part by a continuous migration of young people from farms to city. The abandonment of people produced that farmers must to hire external workers what increased the costs, and the selling price is regulated by free market, without specific state regulations. In simple words, the low profitability of fique is not enough to pay the relative high cost of labor force and maintain an austere lifestyle. To illustrate this situation the salary of one external worker was calculated in 204 USD and the salary of one family of farmers was calculated in 215 USD, an equivalent to 71.67 USD *per capita*. If external workers could be removal of the equation, the equivalent salary *per capita* could be 119 USD, a 66% higher.

In one hand, due to climate change farmers are lost a hug amount of plants, because high temperature accelerates blooming stage, this means that lifetime plant is shorter. If farmers have fewer plants, they have less income, and how to replant is expensive some farmers prefer to change for another crop with better profitability. Nevertheless, surfaces are small and new crops have a subsistence function and not necessarily contribute as an extra income. The situation of decreasing surface with fique affects companies, because they have fewer raw materials and then they need to buy fiber in other areas to cover the gap. Consequently, their costs are higher and the price for *cabuya* cannot to increase, and this cause a vicious circle. In the other hand, both farmers and companies get the feeling of abandonment by government, and companies are trying to support farmers with seed or advices, but it is more difficult over time with small profit margins. One can consider that a vicious circle is negative, but in John Milton words *every cloud has a silver lining,* and the idea of permaculture is a good starting point. Farmers unknowingly began a permaculture system where in the same surface they have different crops, having thus a better use of fertile soil and also reducing economical loses, like the first 3years without fique's harvest. They only need an adequate training to increase crop efficiency and cash flow.[20–24]

The information provided at this time shows that farmers have precarious living conditions, an aged population, high cost of labor force, low sale prices, and lack of education. In addition to an inefficient selling system with intermediaries, substitute products, misuse of raw material, and lack of site policies. More over Colombia as country does not have a unified production system in fique chain, and every part is working individually without business vision. The problem here is that free market regulation could make unfavorable situations to small producers; and whole Santander area is a small producer compared to Nariño or Cauca, thus has less comparative advantages. The system is not communicated between regions and prices or produced volumes have not regulations that include independent provincial needs. This means that government or any institution cannot make specific policies to foment production or assign resources.

Another possible solution in Santander to reduce the gap could be the foundation of productive communities, with different farmers working as a unit, because they could support each others, profit margins will be higher, they could stagger the harvest with the purpose of sell cabuya every month instead of 3times per year, and they will have more opportunities to negotiate price by volume. A second strategy to get better prices could be remodel the final product and enter into organic or ecofriendly markets, because fique production is handmade, without agrochemicals, and water feet is really small too. Nowadays, the only impediment is to acquire certifications like FairTrade, Good Agricultural Practices, ISO 14000, among others. Obviously, they do not have them because the process and the price are expensive, but they could start with a better traceability, individual qualifications, labels or safety.[25–27]

As a separate point, if they decide to optimize the production system the investment is higher, because the useful part of fique is 4% and the whole market is exclusively designed to fiber, that does not include sub-products and it is risky to start new companies in a decreasing market. It also could create uncertainty in the actual market of sack, because *cabuya* is a scarce resource in Santander. In other hand due to the complex topography of the region, costs of harvest and transport will increase severally. In spite of the idea of using the 96% of raw material to elaborate new products look attractive; it is a delicate area to analyze, because entry barriers are high. But a first step to achieve this goal is increase investment in marketing in an indirect way. For example, it is known that fique roots can help in soil protection and underground water storage, then it is optimal to cover non-agricultural surface with fique like slopes and highways berms. On one side, plants will increase sustainability of the project keeping safe the soil; on the other side fique will be more visible and this could increase the interest of new companies. If the first step is

possible, and people have more access to plantations the future costs of harvest and transportation will decrease because companies could have an easier way to pick up fique's leaves in trucks. This will not affect the amount of *cabuya* to make sacks or handcrafts and price of fique could increase because demand of raw material will increase.

As a final topic to discuss in this paper is necessary to explain why the washing tanks have not only an environmental impact, these also have a social effect because rivers are not in every place and the cost and effort of moving the fiber to the river is a lot. Then farmers have no options, on one side to build a tank is expensive and water could be not enough to fill it; on the other side, to produce fiber they need to wash *cabuya* in river and pay the extra cost, this in addition to environmental damage. This system even if works is not optimal and a possible solution is to study a central point to build common tanks, in this way more people would benefit and fewer people would wash in rivers.

Conclusion

Recapitulating information, the studied area is characterized by poverty and fique fiber is a commodity without any differentiation of other natural fibers. But it is a fiber with high potential because there are 96% of raw material that can be used in valuated markets, this means that it is a crop that is worth giving it a try; and not only in a economical way, also deserves a social point of view, because people do not want to change fique for another crops, even if those have better profitability. Farmers feel nostalgic when speak about fique, it is the only job that they had in the whole life and it is a family tradition during several generations. To achieve the goal of a clean and unique product is necessary the collaboration of every stakeholder, and everyone working with the same business focus. Fique market must to change, it needs an extreme makeover in diversification and technology. Also, productive chain needs to be stronger and sub-products should be promoted for the purpose of converting Colombia in a pioneer country in waste reduction, natural resource protection, promotion of rural sustainable economy, and even leaders in environmental technologies.

In one hand, Colombian government knows the issues related with fique production and they created some norms to regulate the problem, but in modern times minimum requirements are not enough to compete in a global market, and there are several management models and certifications that could be useful in this situation; the big problem to implement a large-scale plan like this is the cost, and also it require a lot of collaboration, commitment, training, and follow up the project over time to ensure quality and stability. In the other hand, it is mandatory to work as a unit with future business vision. Nonetheless, government and companies cannot to forget the social component and it is necessary to study each case rigorously, because a solution for one community could not to fix the problem in other places. In those cases are necessaries flexible projects with measurable goals in short, middle, and large time. To conclude, and answering the question of this research -Is the rebirth of natural fibers possible? Fique fiber offers great potential, because there is evidence of a global demand of sustainable products, more over if those products support rural communities. Nevertheless, the actual situation of fique is not focused in global market and it is growing slower than speed of global development. If fique production continuous at that pace it will be obsolete sooner or later and over passed by other fibers like sisal, yute or the fiber that market will be needed in that moment.

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Conflicts of interest

The authors declare that there is no conflict of interest.

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